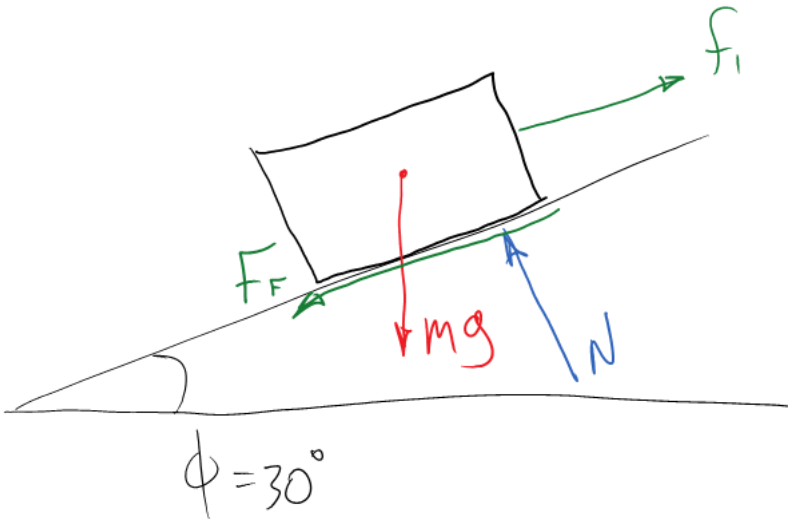
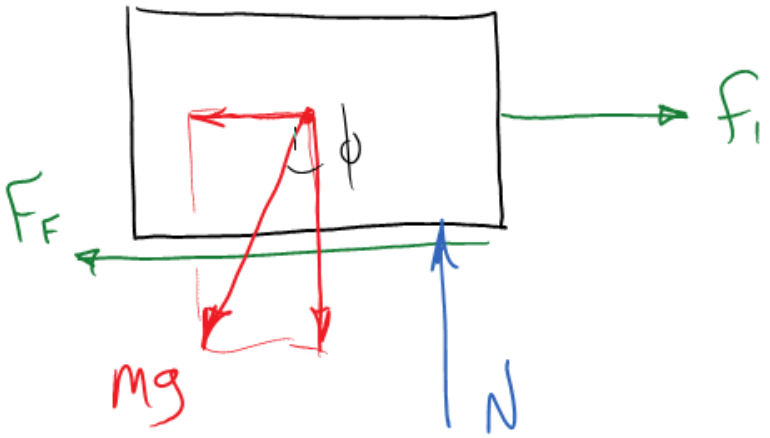
Problem 10.14:

14. A certain mass, $m = 2$ kg, moves on a surface inclined at an angle $\phi = 30°$ above the horizontal. Its initial velocity is $v(0) = 3$ m/s up the incline. An external force of $f_1 = 5$ N acts on it parallel to and up the incline. The coefficient of Coulomb friction is $\mu = 0.5$. Use the Sign block and create a Simulink model to solve for the velocity of the mass until the mass comes to rest. Use the model to determine the time at which the mass comes to rest.

Free-Body Diagram:





$$\sum F_y = 0: \; N - mg\cos\varphi = 0$$

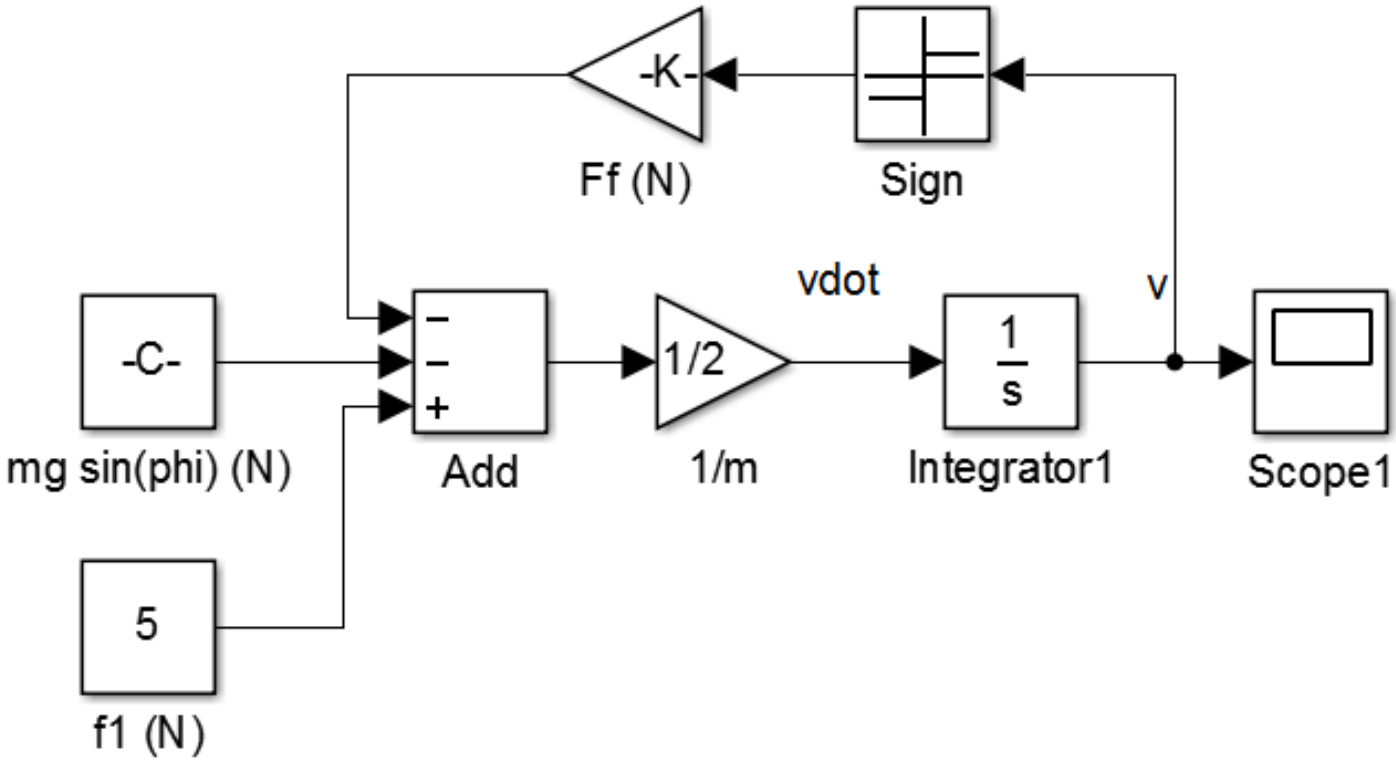
$$N = mg\cos\varphi$$

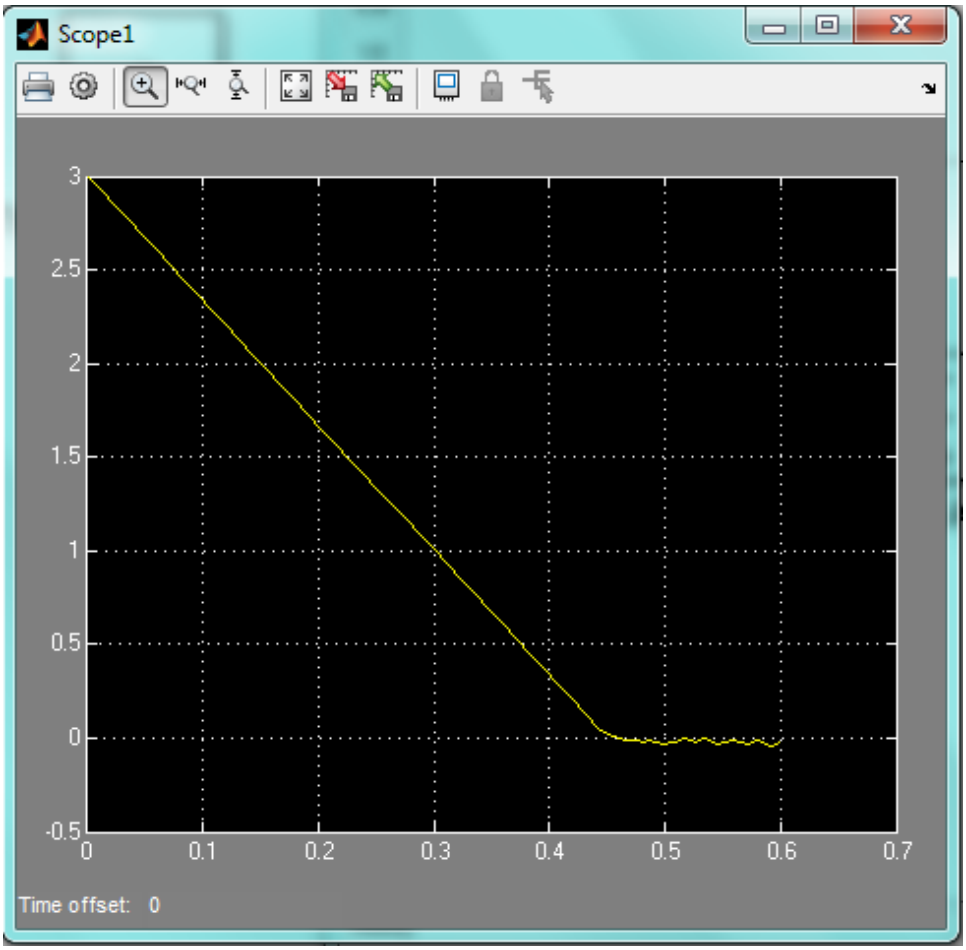
$$F_F = \mu N = \mu mg\cos\varphi$$

$$\sum F_x = ma: \quad f_1 - F_F - mg\sin\varphi = ma$$

$$a = \dot{v} = \frac{1}{m}(f_1 - F_F - mg\sin\varphi)$$

The sign on F_F changes when the body stops moving up the ramp (when the velocity goes negative).





After the block comes to rest, it stays in place. It does not slide back down the ramp.